Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

Clinical Observation on Mcmonnies Dry Eye Score in Postmenopausal Women

SonaliSarangi, Madan Mohan Mohapatra, Ramesh Chandra Mohapatra*
Department of Ophthalmology, IMS and Sum Hospital, SOA deemed to be University,Bhubaneswar
Corresponding author
Ramesh Chandra Mohapatra, Professor and Head Department of Ophthalmology, IMS and Sum Hospital, SOA deemed to be University,Bhubaneswar

Abstract
Dry eye syndrome is a disease of the ocular surface and tear film that is predominantly in older adults. Even though the degree of visual acuity loss in dry eye patients is commonly mild-to-moderate, in the aging population, this minimal change in visual status can lead to a significant decrease in visual function and quality of life. In this study we weobserve the clinical usefulness of McMonnies questionnaire in dry eye disorders and to compare it with other dry eye parameters in postmenopausal women. Out of 100 patients who attended the ophthalmology OPD at IMS AND SUM Hospital, they were divided according to their age into 40-45 years (18%), 46-50years (26%), 51-55 years (29%) and 56-60 years (27%). The correlations of McMonnies score with the standard tests for dry eyes were observed.Prevalence of pathological dry eyes according to age group 40-45 years, 46-50 years, 51-55 years and 56-60 years age group was found to be 11.11%, 30.76%, 24.13%, and 25.92% respectively. This McMonnies questionnaire alone as an equivalent to standard test for dry eyes in a larger community, without performing the tests on the patients' eyes on a community scale and especially on those who are more prone to have dry eye disease or disorders .

Introduction
Dry eye syndrome is a disease of the ocular surface and tear film that is predominantly in older adults. Even though the degree of visual acuity loss in dry eye patients is commonly mild-to-moderate, in the aging population, this minimal change in visual status can lead to a significant decrease in visual function and quality of life . The International Dry Eye Workshop has defined dry eye as a 'disease of the tears and ocular surface' that results in symptoms of discomfort and is accompanied by increased osmolality of the tear film and inflammation of the ocular surface. Reported prevalence of dry eye is diverse, with questionnaire based surveys documenting rates ranging from 14.4% to 33% of the population sampled.[1,2] The prevalence of DED is high and ranges from 5% to 33% of the adult population worldwide.[3]
The emerging roles of ocular surface and lacrimal gland inflammation, sex hormone imbalance (especially androgen deficiency), and dysfunction of the lacrimal and meibomian glands have been evaluated both in animal models and in humans.[4,5] Inflammation of the ocular surface, including inflammation of the lacrimal gland, is a feature of many forms of dry eye.[6]Kaswan et al [7] first reported this feature in a spontaneous form of dry eye in dogs.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

The inflammation in the conjunctiva of both dogs[8] and humans[9] with dry eyes consists primarily of T lymphocytes.

Dry Eye Disease (DED) is considered to be a symptomatic disease,[10] and many patients experience eye irritation, stinging, dryness, ocular fatigue, and fluctuating visual disturbances.[11] These symptoms can lead to significant functional impairment in daily and social activities, quality of life, and productivity among affected patients. [12] DES also poses a substantial economic burden to payers, patients, and society owing to associated health care costs and loss of productivity.[13] Taking the non-specific symptomatology of DES , McMonnie in the year 1987 formulated some questionnaires with reference to the symptoms similar to those felt in DES which are matched against the standard tests recommended for dry eye conditions to find out of such questionnaire have relevance to the tests. In this study we observe the clinical usefulness of McMonnies questionnaire in dry eye disorders and to compare it with other dry eye parameters in postmenopausal women

Material and methods

Patients attending outpatient department (OPD) at IMS & SUM hospital, and who also gave their valuable consent were included in the study. Approval from the institutional ethics committee had been obtained prior to the start of the study. Informed consent was obtained from subjects recruited for the study.The study was done at the IMS & SUM hospital, Bhubaneswar, Odisha.The study was done from January 2015 to May 2016. This was then followed by tabulation and analysis of the data. 100 post-menopausal women having symptoms of dry eyes were included in the study. All the patients were subjected to dry eye testing and McMonnies questionnaire.Study tool we have used like Slit lamp biomicroscope, McMonnies Questionnaire (for one patient), Fluorescein 1% tear strip (two strips for both eyes), Schirmer's strips (two strips for both eyes), Graticule (attached to the slit-lamp), Stop-watch etc.

A detailed thorough symptoms of dry eyes were asked and tabulated and noted in the McMonnies Questionnaire. Also those patients were subjected to Shirmer's test, Tear Film Break-UP Time, and the tear film height was also caliberated by using the graticule present at the slit lamp.

Inclusion criteria:

Post-menopausal women aged between 40years to 60 years of age, Those who had symptoms of dry eyes, k/c/o Diabetes were included

Exclusion criteria: Obvious ocular disease such as allergic conjunctivitis , bacterial conjunctivitis, acute anterior uveitis,Specific diseases causing dry eyes such sjogren's syndrome , SLE, etc.Post surgery (cataract , pterygium) patients were excluded from the study.

McMonnies Questionnaire: A validated 12-item McMonnies Dry Eye Questionnaire was used . Scores were given to each response. A score of <10 was labeled normal, of 10-20 marginal dry eye, and of >20 pathological dry eye.**[16]**Scores are tabulated using a weighted-point assignment" based on clinical experience", where all scores are summed, with weights obtained to calculate an overall "Index"**[17]**. The Index ranges from 0 to 45, where a higher score is regarded as more indicative of DED **[18]**. A cut-point of greater than 14.5 is recommended for a dry eye diagnosis**[18]**.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

Tear Film Break-Up Time: **(TBUT)**

A 2% fluoroscein strip was moistened and placed in the lateral one-third of lower lid in a non-anaesthetised eye and patient was asked to blink only once or twice to avoid pooling of fluorescein, following which the strip was removed. Using the cobalt blue light of the slit lamp, the time lapse between the last blink and the appearance of the first randomly distributed dark discontinuity in the fluoroscein-stained tear film was noted with the help of a stop watch . Values of less than 10 seconds were considered abnormal. Tear Film Break Up Time was most frequently reported positive test. A rapid tear film break up time is seen in both aqueous tear deficiency as well as Meibomian gland dysfunction. The lid abnormalities and Meibomian gland dysfunction were also associated with abnormal tear film break-up time. This break-up time is the interval between the last blink and the appearance of the first randomly distributed dry spot .

Where the TBUT is less than the blink interval, it is implied that tear film breakup in that individual is occurring normally in the waking state. (this state is expressed by the Ocular Protection Index), which is the ratio of the TBUT divided by the blink interval. When this value is less than 1, then tear film breakup occurs in the waking, open-eye condition. If the TBUT is greater than the blink interval but less than 10 seconds, then this TBUT value is still currently regarded as an index of tear film instability. Where tear film instability represents tear film breakup occurring within the blink interval, it is assumed to give rise to local drying and hyperosmolarity of the exposed surface, to surface epithelial damage, and to a disturbance of glycocalyx and goblet cell mucins. The latter consequently exacerbates the tear film instability as part of a vicious circle of events.

SCHIRMER'S TEST

A standard Schirmer's strip,(wetting of special Whatman paper no. 41), 5mm wide and 35 mm long, was placed over the lateral one-third of lower lid without anaesthesia (Schirmer's test 1) which measures the maximum basic and reflex secretion. Then, the patient is asked to close the eyes gently for 5 minutes. After five minutes, the level of strip wetting (in millimetres) was noted. Reading less than ten millimetres wetting was considered as positive Schirmer's test. Schirmer's test positive was considered as Aqueuous Tear Deficiency.

Positive signs were if one or both eyes revealed tear film breakup time (TBUT) of<10s, a Schirmer test score of <10 mm[18]

Tear meniscus height:

Use of variable beam height or a graticule on a slit lamp after asking the patient to sit in front of the slit-lamp and measuring and grading of meniscus integrity using slit lamp. Tear meniscus height if taken more than 0.5mm is assumed as normal but if less than equal to 0.5mm, then is considered as abnormal and indicative of dry eyes.

Result

During the study period from January 2015 to May 2016, a total of 100 patients who fulfilled the inclusion criteria were included in the study. This was carried out in patients who visited the ophthalmology OPD, at IMS and SUM hospital. All 100 patients who complained of one or more symptoms were screened for dry eye using McMonnies dry eye questionnaire and were subjected to Tear film height, Schirmer's test, and TBUT test.

Out of 100 patients, post-menopausal age group belonging to age 40-45 years were 18 (18%) , 46-50years of age.(26%), 51-55 years (29%) , 56-60 years of age.(27 %).

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

Clinical observation

Table 1: Clinical observation on McMonnies score for dry eyes in post-menopausal women with 40-45 years of total 18 patients along with their symptoms and past history are tabulated below.

Symptoms/	**Tear film height**		**TBUT**			**Schirmer's test**			**McMonnies score**			**Total**
	<0.5	**>0.5**	**<5**	**5-10**	**>10**	**<5**	**5-10**	**>10**	**<10**	**10-20**	**>20**	
H/osoreness	09	01	05	03	02	00	04	08	0	07	02	41
Scratchiness	11	01	08	03	01	00	06	06	01	10	02	49
Dryness	05	01	03	02	01	00	03	03	00	04	02	38
Grittiness	12	01	05	06	02	00	06	07	02	10	01	48
Burning	10	01	05	04	02	00	04	07	02	08	01	44
Arthritis	16	01	08	05	02	00	07	08	01	11	02	61
Thyroid	10	01	04	05	02	00	03	08	03	10	01	47
Morning irritation	08	01	05	04	02	00	07	04	00	10	02	43
Individual test results	89		89			91			92			

Forexample, the symptom of soreness, complained by the number of patients, belonging to age-group 40-45 years, and who had tear film height of <0.5mm is 9 and tear film height >0.5mm is only 1patient. Similarly, the number of patients complaining of various symptoms written as soreness, scratchiness, dryness, grittiness, burning were counted and put according to their symptoms and corresponding test values. At the end, the grand total of individual tests were added to get the results **(Table-1).**

Statistical analysis

Correlation coefficient:

The correlation coefficient is a number between –1 and 1 that determines whether two paired sets of data (such as those for *height* and *intelligence* of a group of people) are related. The closer to 1 the more 'confident' we are of a positive linear correlation and the closer to –1 the more confident we are of a negative linear correlation (which happens when, for example one set of numbers tends to decrease when the other set increases as you might expect if you plotted a person's age against the number of toys they possess). When the correlation coefficient is close to zero there is no evidence of any relationship. Confidence in a relationship is formally determined not just by the correlation coefficient but also by the number of pairs in your data. If there are very few pairs then the coefficient needs to be very close to 1 or –1 for it to be deemed 'statistically significant', but if there are many pairs then a coefficient closer to 0 can still be considered 'highly significant'. The calculation of the *r* value is based on a number of assumptions that are beyond the scope of this discussion, but people who need *r* values can simply look them up in standard statistical tables (they are also

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

computed automatically in Excel when you run Excel's regression tool). The tables (or Excel) will tell you. Interrelationship studies between different variables are very helpful tools in promoting research and opening new frontiers of knowledge. The study of correlation reduces the range of uncertainly associated with decision making.

The numerical values of correlation coefficient (r) for 3 tests are tabulated in the form of correlation matrix. The highest positive linear correlation is observed between Correlation ship between McMonnies scores and Schirmer's test with the age of 40-45 was (0.464) but there was no Correlation between McMonnies scores with tear-film height and TBUT in the the age group of 40-45.

Table 2. Correlation ship between McMonnies scores and Tear film height with the age of 40-45 years N= 18(%) "P" denotes prevalence.

Score group	**Tear film height**			**Total**	**Value**
	Grade 2 (<0.5mm)	**Grade 1 (>0.5)**	**Grade 0**		
Normal <10	4	0	0	4	R = (-0.13)
Marginal dry eye (10-20)	11	1	0	12 (P=66.66%)	
Pathological (>20)	2	0	0	2 (P= 11.11%)	

R value is "not statistical significant" since it is not near to -1.

Table 3. Correlation ship between McMonnies scores and TBUT with the age of 40-45 years N= 18

Score group	**TBUT**			**Total**	***R value***
	Grade 2 (<5 Sec)	**Grade 1 (5-10 sec)**	**Grade 0 (>10)**		
Normal <10	1	5	3	9	R = (0.196)
Marginal dry eye (10-20)	5	2	0	7 (P=38.88%)	
Pathological dry eye (>20)	2	0	0	2 (11.11%)	

R value is "not statistical significant" since it is not near to +1.

Table 4. Correlation ship between McMonnies scores and Schirmer's test with the age of 40-45years N=18

Score group	**Schirmer's test**			**Total**	***R value***
	Grade 2 (<5 mm)	**Grade 1 (5-10 mm)**	**Grade 0 (>10 mm)**		
Normal <10	0	0	3	3	R= (0.464)
Marginal dry eye (10-20)	0	6	7	13 (P=72.22%)	
Pathological dry	0	0	2	2	

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

eye(>20)				(P=11.11%)	

R value is" statistical significant" since it is near to +1 (positive linear correlation).

Table 5: Clinical observation on McMonnies score for dry eyes in post-menopausal women with 45-60 years of total 82 patients

Symptoms	Tear film height		TBUT			Schirmer's test			McMonnies score			Total
	<0.5	>0.5	<5	5-10	>10	<5	5-10	>10	<10	10-20	>20	
Soreness	52	04	39	11	01	16	20	16	03	27	24	213
Scratchiness	57	08	44	18	02	17	22	21	05	36	24	271
Dryness	39	04	34	10	01	14	11	14	02	20	21	170
Grittiness	51	08	40	18	01	14	19	21	03	34	22	231
Burning	47	06	36	10	02	15	16	18	04	27	22	203
Arthritis	59	07	52	14	01	19	27	18	03	40	24	264
Thyroid	38	06	32	12	01	10	18	18	00	27	19	181
Morning irritation	36	05	30	12	01	15	12	15	00	22	20	168
Individual test results	429		422			?406			429			

According to all the five symptoms present in McMonnies questionnaire, scratchiness followed by grittiness and soreness were the major complaints overall amongst the age group 45-60 years of age.

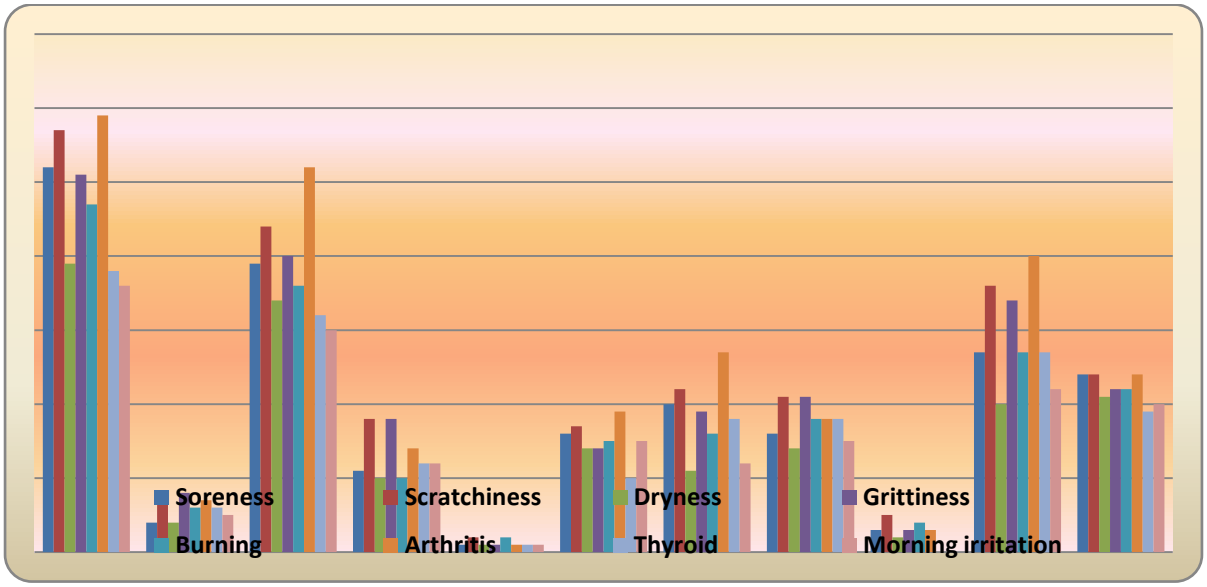

Fig:1showing overall symptoms in age:45-60 years along with test results.

Non-speific arthritis problems were amongst the highest positive past history given by patients belonging to 45-60 years of age (no. of patients = 82).

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

Statistical Analysis

Correlation coefficient:

The correlation coefficient is a number between –1 and 1 that determines whether two paired sets of data are related. If there are very few pairs then the coefficient needs to be very close to 1 or –1 for it to be deemed 'statistically significant', but if there are many pairs then a coefficient closer to 0 can still be considered 'highly significant'.

Table-6. Correlation ship between McMonnies scores and Schirmer's test with the age of 46-50 years N=26.

Score group	**Schirmer's test**			**Total**	***R value***
	Grade 2 (<5 mm)	**Grade 1 (5-10 mm)**	**Grade 0 (>10 mm)**		
Normal <10	0	1	3	4	R = (0.709)
Marginal dry eye (10-20)	4	5	4	13 (P=50%)	
Pathological dry eye (>20)	3	3	3	9 (P=34.61%)	

R value is "statistically significant" since it is near to +1 (positive linear correlation).

Table 7. Correlation ship between McMonnies scores and Tear film height with the age of 51-55 years N= 29(%)

Score group	**Tear film height**		**Total**	**Value**
	Grade 2 <0.5	**Grade 1 >0.5**		
Normal <10	5	0	5	R = (0.181)
Marginal dry eye (10-20)	15	2	17 (P=58.62%)	
Pathological (>20)	5	2	7(P=24.13%)	

R value is " not statistical significant" since it is not near to +1 **.**

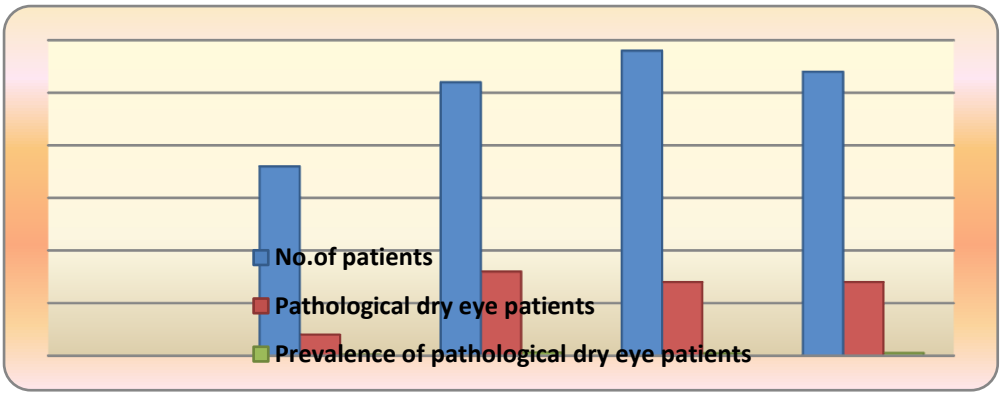

Fig 2: Bar diagram showing relationship between no. of patients , pathological dry eye patients and its prevalence.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

Table 8 : Comparision between mean McMonnies score & mean Marginal dry eye score

Age group	Mean McMonnies score	Mean marginal MMS
40-45	14.80	15.88
46-50	16.88	15.83
51-55	16.96	17.52
56-60	18.40	17.94

Table 9: Comparisionbetween overall mean McMonnies score & mean pathological dry eye

Age group	Mean McMonnies score	Mean pathological MMS
40-45	14.80	21.5
46-50	16.88	22.88
51-55	16.96	21.71
56-60	18.40	23.57

Table 10: Tabulated values of coefficient correlation (R) values with respective tests and McMonnies score according to specific age group.

Age group	McMonnies with different tests	R values	
40-45	Tear film height	- 0.130	(no correlation)
	TBUT	0.196	(no correlation)
	Schirmer's test	0.464	(good correlation)
46-50	Tear film height	-0.890	(good correlation)
	TBUT	-1.780	(no correlation)
	Schirmer's test	0.709	(good correlation)
51-55	Tear film height	0.181	(no corelation)
	TBUT	-0.760	(good correlation)
	Schirmer's test	-1.140	(no correlation)
55-60	Tear film height	0.546	(good correlation)
	TBUT	0.464	(good correlation)
	Schirmer's test	-0.390	(good correlation)

Discussion

Dry eye disease is a major tear deficiency disorder that affects millions of people world-wide. It is a distressing problem which is often overlooked and under-diagnosed.

A healthy tear film nourishes, lubricates and protects the ocular surface. Any dysfunction of the main or accessory lacrimal glands, the meibomian glands, eyelids, cornea, conjunctiva or the connecting neural reflex arcs (the components which together form the lacrimal functional unit) causes tear film instability, symptoms of grittiness and irritation, ocular surface inflammation and ultimately signs of ocular surface damage and visual impairment . Whilst dry eye patients report similar symptoms of dryness, grittiness, irritation and burning,

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

the causes can be diverse. It can interfere with daily social and physical functioning, with a significant impact on work place productivity.The present study constitutes mainly of the post-menopausal age group from 40-60years of age where as patients included in study by Vijaya K. Gothwal, et al [80] were from 45 years above females with rheumatoid arthritis . The study done by Furong Tang [81] studied on large population including age more than 20 years including males and females. YuxinGuo, RongmeiPeng, et al[17] studied the incidence of dry eyes in both males and females. In the present study, prevalence of dry eyes was based on the evidence of total pathological score of McMonnies dry eyes score (which comprises of symptoms such as soreness, scratchiness, dryness, grittiness and burning sensation) and which corroborated well with the standard tests for dry eyes namely tear-film height, Shirmer's test and tear film break-up time.

The prevalence of pathological dry eye score was 11.11% (amongst 40-45years), 30.76% (in 46-50 years), 24.13% (in 51-55 years) and 25.92% (in 56-60years), all being in their post-menopausal phase. This indicates a good association between subjective symptoms and clinical tests.

The prevalence of dry eyes in the present study was 16.76% (40-60years), which was almost similar than the reports of US based Beaver dam study where prevalence was 14.4%, Salisbury eye study (14.6%) and Australian 's blue mountain study 16.6%. However, few studies from Asia has relatively higher prevalence than our study such as Sumatra (27.5%), Shihpai (33.7%). Few studies US, women's health study showed (7.8%), and Australian, Melbourne visual impairement project (5.5%) showed less prevalence of dry eyes as compared to our study. This was seen on the account of mean McMonnies scoring where the cut off range was taken as 14.5 as reported by McMoonies and Ho. In previous studies, there was comparison between various symptoms and the p- value was found to be significant as in the study made by Bhatnagar et al [19] but in our present study, the statistic used was correlation coefficient between McMonnies scoring of patients aged between 40 to 60 years, with the standard tests for dry eyes as shown above.

This showed that tear film height & TBUT (40-45 years), TBUT (46-50years), Schirmer's test and tear film height (56-60 years) did not correlate with the McMonnies questionnaire.

The correlation coefficient between Schirmer's test (40-45 years), tear-film height and Shirmer's test (46-50 years), TBUT (51-55years) and all the three standard test for dry eyes with McMonnies score was " statistically significant."

Lower prevalence by Schirmer test (51-55 years) and tear film height (40-45 years, 51-55 years) may be explained by the fact that many patients with symptoms of dry eye syndrome may have a normal aqueous tear production and normal Schirmer score. In such cases their symptoms may be caused by the common, but not always properly diagnosed, condition meibomian gland dysfunction. Another possibility is a poor mucin layer resulting in poor adherence of tears to the ocular surface. Yet another explanation for variable schirmer test results is the inter- and intra-patient variability, that is normal human tear volume may range from 7 µL to 30 µL, while tear turnover rates range from0.5 µL/min to 2.2 µL/min. Moreover, Shirmer's test is known to give variable results[20,21].

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

In the present study within the age group of 40-50 years of age, TBUT results did not corroborate with the McMonnies scoring. This could be due to non-expression of symptoms by the females towards certain diseases but could be positive when subjected to relevant tests.

Conclusion

Symptom assessment plays a large role in the diagnosis of dry eye which are included individually in McMonnies questionnaire . This is important because in the present study we noticed that the symptoms are having a correlation to the standard test for dry eyes because it invariably has the effect on the overall McMonnies total scoring system. If patient's symptoms are affecting her day to day activities , they should be treated for dry eye after ruling out other causative factors.Moreover , McMonnies score also correlates significantly with the tear-film height (except 40-45 years and 51-55years) ; TBUT (except age group 40-50 years) and Schirmer's test (except age group 51-55 years).Hence, there was an overall statistical significant correlation between McMonnies scoring in post menopausal women (heighest56-60years) and the standards tests for dry eyes, TBUT being taken as gold standard in earlier literatures. Thus, we can use this McMonnies questionnaire alone as an equivalent to standard test for dry eyes in a larger community, without performing the tests on the patients' eyes on a community scale and especially on those who are more prone to have dry eye disease or disorders.

Reference

1. CaffreyBE, Richter D, Simpson T, et al. The Canadian dry eye epidemiology study. In: Sullivan DA, et al, ed. Lacrimal gland, tear film and dry eye syndromes 2. New York: Plenum Press, 1998:805–6.
2. Shimmura S, Shimazaki J, Tsubota K. Results of a population-based questionnaire on the symptoms and lifestyles associated with dry eyes. Cornea 1999;4:408–11. Arch Ophthalmol 2000;118:1264–8.
3.DEWS. The epidemiology of dry eye disease: report of the Epidemiology Subcommittee of the International Dry Eye WorkShop (2007). *Ocul Surf*. 2007;5(2):93–107.
4. Matoba AY, Harris DJ, Meisler DM, et al. *Preferred Practice Pattern: Dry Eye Syndrome*. San Francisco: American Academy of Ophthalmology, 2003.
5.Shimmura S, Shimazaki J, Tsubota K. Results of a population-based questionnaire on the symptoms and lifestyles associated with dry eyes. Cornea 1999;4:408–11. Arch Ophthalmol 2000;118:1264–8.
6. Kaswan RL, Salisbury MA, Ward DA.Spontaneous canine keratoconjunctivitissicca. A useful model for human keratoconjunctivitissicca : treatment with cyclosporine eye drops. *Arch Ophthalmol*. 1989;107: 1210–1216.
7.Kaswan RL, Salisbury MA, Ward DA. Spontaneous canine keratoconjunctivitissicca. A useful model for human keratoconjunctivitissicca: treatment with cyclosporine eye drops. *Arch Ophthalmol*. 1989;107: 1210–1216.
8. Stern ME, Gao J, Schwalb TA, et al. Conjunctival T-cell subpopulations in Sjogren's and non-Sjogren's patients with dry eye. *Invest Ophthalmol Vis Sci*. 2002;43:2609–2614.
9. DEWS. The epidemiology of dry eye disease: report of the Epidemiology Subcommittee of the International Dry Eye WorkShop (2007). *Ocul Surf*. 2007;5(2):93–107.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 4, 2021, Pages. 14268 - 14278
Received 05 March 2021; Accepted 01 April 2021.

10. Johnson ME. The association between symptoms of discomfort and signs in dry eye. *Ocul Surf*. 2009;7(4):199–211.
11. Miljanovic B, Dana R, Sullivan DA, Schaumberg DA. Impact of dry eye syndrome on vision-related quality of life. *Am J Ophthalmol*. 2007;143(3):409–415.
12. Yu J, Asche CV, Fairchild CJ. The economic burden of dry eye disease in the United States: a decision tree analysis. *Cornea*. 2011;30(4): 379–387.
13. Cornea • Volume 24, Number 1, January 2005 The Tear Film Complex © 2004 Lippincott Williams & Wilkins 3
14. Krachmer text book of cornea fundamentals.
15. Bhatnagar KR, Pote S, Pujari S, Deka D. Validity of subjective assessment as screening tool for dry eye disease and its association with clinical tests. 2015;8(1):174-181
16. Rolando M. Tear mucus ferning test in normal and keratoconjunctivitissicca eyes. ChibretInt J Ophthalmol 1984;2;33-41.
17. Yokoi N, Bron AJ, Tiffany JM, Kinoshita S . Reflective meniscometry: a new field of dry eye assessment. Cornea 2000;19(3 suppl);S37-S43.
18. Yokoi N. BronA,TiffanyJ,Brown N, and HsuanJ,Fowler C. Reflective meniscometry: a non-invasive method to measure tear meniscus curvature. Br J Ophthalmol 1999; 83;92-97.
19. Yokoi N,Kinoshita S, Bron AJ, Tiffany JM, Sugita J, Inatomi T. Tear meniscus changes during cotton thread and Schirmer testing. Invest ophthalmol Vis Sci 2000;41;3748-3753.
20. Vijaya K. Gothwal,1,2 Konrad Pesudovs,1 Thomas A. Wright,1 and Charles W. McMonnies3 Investigative Ophthalmology & Visual Science, March 2010, Vol. 51, No. 3 Copyright © Association for Research in Vision and Ophthalmology
21. YuxinGuo, RongmeiPeng, Kang Feng, and Jing Hong , Department of Ophthalmology, Peking UniversityThird Hospital, 49 North Garden Road, Haidian District, Beijing 100191, China